

Dr. F. St. George Mivart's Report to the Local Government  
Board on the Sanitary Circumstances and Administration  
of the Borough of Christchurch, South Hants.

RICHARD THORNE THORNE,  
Medical Department,  
January 21st, 1899.

For a number of years past the unsatisfactory condition of the water supply and sewerage of the Borough of Christchurch, as sufficiently revealed by annual reports of the Medical Officer of Health, and occasional local complaints, has from time to time been under observation by the Board. In particular, the discharge of crude sewage from certain sewers into the waters of the rivers Stour and Avon at points within the borough area has been much in evidence. Two inquiries with respect to an application for the issue of an Order determining to what extent the tidal waters of the rivers Stour and Avon shall be deemed to be a "stream" within the meaning of the Rivers Pollution Prevention Acts of 1876 and 1893 were held by General Crozier and Mr. Tulloch, two of the Board's Engineering Inspectors, on the 31st of August, 1894, and the 27th October, 1896, respectively. After the former of these inquiries, the Board wrote on the 5th October, 1894, to the Town Council of Christchurch, calling their attention to the highly unsatisfactory state of things brought to light and added, "The Board must therefore request that the Town Council will formulate an efficient scheme of sewerage and sewage disposal for their district at an early date." As the result of the latter inquiry an Order was issued by the Board on the 4th June, 1897, declaring to be a "stream" within the meaning of the above-mentioned Acts, the tidal waters of the Stour and Avon lying to the west of a line drawn across the estuary of the two rivers, locally known as "the Run," at a point adjacent to the spot called "Haven House," and shown on a plan scheduled in the Order. In June, 1897, a temperate and apparently well-grounded complaint in regard to the sanitary condition and administration of the borough was referred to the Town Council for their observations, and after some pressing, an unsatisfactory reply was received from that body. In the early part of the present year, the Annual Report of the Medical Officer of Health once more drew attention to the insanitary state of the borough, and dwelt upon the serious danger arising from a water supply drawn for the most part from shallow wells. In view of the unsatisfactory state of affairs which was thus and in other ways shown to persist in the borough, the Board determined on inspection of it by one of their medical staff, and, in accordance with instructions to make local inquiry, I visited the district early in September, 1898.

GENERAL DESCRIPTION.

The Urban District of Christchurch, which is co-extensive with the Municipal Borough of the same name, has an area of 1,009 acres, and its rateable value is £12,898 18s. 11d. There is no outstanding loan; indeed, no loans have been contracted. The amount of the present General District rate is 8d., with an extra 3d. for road watering over a portion of the District. The numbers of inhabited houses as given in the census returns for 1871, 1881, and 1891 are 664, 716, and 823 respectively; the number is now estimated, as I am informed, to be about 900.

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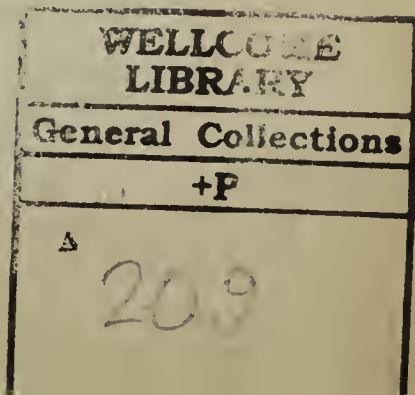
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The population, given in the same returns as 3,064, 3,341, and 3,994, is now stated to be 4,432.

The town is situate at the head of the common estuary of the rivers Stour and Avon, opening into Christchurch Bay. The harbour of Christchurch and the tidal waters communicating with it have the peculiarity of "high-water" twice every tide.

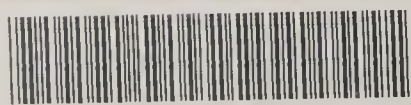
The picturesque old town itself consists of little more than two long straggling streets, together extending over a distance of about three miles. The first—a wide thoroughfare—may be said to reach from the London and South Western Railway Bridge to the Priory; the second, starting from the first almost at a right angle near its southern extremity, crosses the "mill stream" and the river Avon, and, running in a north-easterly direction, passes through or rather forms in itself the quarter of the town known as "Purewell." At the further extremity of this locality it again makes a sharp turn in a rather southerly direction to pass through the suburban portion of the town bearing the name of "Stanpit."

Christchurch now possesses no industries other than those of an agricultural and riparian country town. Formerly an extensive manufacture of "fusée" chains for watches and clocks was carried on here, but this is now, I am informed, quite extinct. Although at present the number each year of seasonal visitors is not very large, a great and increasing number of day excursionists are attracted to the town, owing to its charming situation and surroundings as well as to the facilities for boating and fishing which the locality affords. The salmon fishing of the river Avon enjoys a very high reputation. The ever-growing popularity of the neighbouring town of Bournemouth has led to very extensive building along the high road from that town towards Christchurch, a large proportion of the houses being of a superior class. There would seem indeed to be little doubt that in the near future the entire stretch of country from Poole to Christchurch and beyond will have a continuous urban character.

#### A.—GENERAL SANITARY CONDITION.

Geologically considered, the western portion of the Urban District stands upon a deposit of gravel, of varying depth. But from the eastern bank of the Mill Stream to the extremity of "Purewell," the buildings rest upon alluvial beds of considerable depth, composed probably of tidal mud, peat, &c. From "Purewell" to the extremity of the district at "Stanpit" the high road may be practically considered to mark the edge of another stretch of gravel, the road having in all probability been placed here so as to secure a firm bed. This stretch of gravel extends to the eastern and north-eastern limits of the district. On either side of the "Mill Stream" the gravel beds are underlain conformably by the "Bracklesham beds" of various coloured clays and sands. From the facts brought to my notice I think it possible that the varying depth of the wells in those portions of the town standing upon gravel indicates approximately the actual thickness of the gravel deposit at those points, and that the contained water rests upon the clayey formation beneath.

*Streets, Dwellings, and House Accommodation.*—I learn from the Surveyor that there are between nine and ten miles of roadway in the district, six to seven being dedicated, and that of these some two miles are county high roads. The principal street is generally of sufficient width, save at the Bridges, and is nearly all macadamized—the side-pavements being of stone or blue brick. The houses are for the most part built of brick, and the larger residences appeared to be of sufficiently substantial construction. But a large number of cottages are undoubtedly of an unsatisfactory character, having dilapidated walls, floors, and ceilings, as well as being insufficiently ventilated. In many instances eave spouting is altogether absent and in others it is defective, while in numerous cases down-fall pipes deliver rain water either upon the walls, or upon the ground at the foot of them, to soak into the foundations. Nor is this defect confined to small private dwellings. A conspicuous example of it is seen at the National Schools, parts of which are of recent construction. Here the down-fall pipes deliver some inches above the ground at the foot of the walls of the building. The level of the playground has recently been raised, I



am informed, the idea being that the water would run off instead of soaking away.

On the outskirts of the town there are cottage dwellings practically built of mud and gravel. Some of these have been recently condemned and are now uninhabited. It appeared to me that others should be dealt with in a similar manner. Some of the small houses stand closely together near the main street and have but very little curtilage; nevertheless, it may be said that on the whole there is a fair amount of garden ground available for cottagers, though unequally and often disadvantageously placed. Back yards are roughly and imperfectly paved in many instances, or not paved at all. Owing to the extraordinary drought that had prevailed for some months prior to the time of my visit it was difficult to judge accurately in all cases as to dampness, but there can be no doubt that curtilages in this district are frequently in a sodden condition in ordinary seasons.

I am informed that overcrowding of persons occurs from time to time and is difficult to deal with, inasmuch as when abatement of it is secured in one house it frequently recurs in another; but, however this may be, no cases of overcrowding of persons in houses came to my knowledge during my inspection, nor did I find cases of overcrowding of dwellings upon area.

*Water Supply.*—I am informed that it is now believed that out of the 900 inhabited houses in the district, 575 are supplied with water from wells, public or private, while\* 319 are now connected with the mains of the West Hants Water Company, an undertaking established about four years ago, and hereafter to be again referred to. Six houses are said to be without means of water supply.† It may be mentioned that 182 of these houses have been connected since January, 1897, this being in some 26 instances the result of notice under Section 62 of the Public Health Act of 1875.

*Public Wells.*—Five wells are at present utilised for public water supply. Until July last, six were in existence; but one of them in that section of the main street called “Bargates” was closed by order of the Town Council, after having been declared by the Medical Officer of Health to be contaminated with sewage. All these wells are fitted with pumps. Their exact depths I had some difficulty in ascertaining, but I was informed that in none does it exceed 20 feet. Briefly described, they are as follows:—

1. *Railway Inn Well and Pump.*—This well is said to have been opened and cleaned in June, 1897. It is beneath the roadway of the main thoroughfare about 8 feet from the kerb. It is about 16 feet deep and dry-steined. When opened it was found to have been closed at the top by a tightly-fitting stone, but there were signs of percolation at the sides of the well.

2. *High Street Well and Pump.*—The depth of this well is uncertain; probably about 14 feet. It is said to be dry-steined. In a communication to the Board, dated 18th December, 1893, Mr. J. Wallace Peggs speaks of the “report recently made by Dr. Dupré on the water of the High Street Pump.” This report states that the water is “very largely polluted by sewage, and is totally unfit for drinking or other domestic purposes.” [This report will be found in Appendix No. I.] I did not learn that any alterations had been made to the well since the date of the above report.

3. *Church Street Well and Pump.*—This is beneath the main roadway, and is said to be about 20 feet deep and dry-steined.

4. *Pit Well and Pump.*—This is situate in the centre of a small unpaved square down to which the ground slopes from the roadway. The well is said to be about 9 feet deep and dry-steined, and is closed by a stone at the top. The square is almost surrounded by cottage dwellings: across the centre of it and close to the well is said to pass a sewer of 9-inch earthenware pipes, cement jointed, and laid in clay. This sewer is supposed to have been laid about 20 years ago. I regard this well as being from its situation exposed to imminent risk of contamination.

5. *Tutton's Well and Pump.*—This is situate in the suburban quarter known as Stanpit, and stands in a little open patch of grassland sloping down to the edge of a creek leading from the estuary of the Avon. The well, the mouth of which is situated about 45 feet above high water mark, has somewhat recently been cleaned, and reconstructed of 3 feet concrete cylinders. It is said to be fed by a strong spring. Adjacent to the well is a dipping place surrounded by a raised border of ornamental

\* NOTE.—During the course of my inspection I found that already, as a result of my visit, certain property owners had applied to the Water Company to lay on water to a number of cottages where a supply was urgently needed.

† NOTE.—I am informed that since my visit this matter has received attention.

masonry work surmounted by a railing. It is not quite clear how this dipping place is fed, but it is probably kept supplied from the troughing beneath the pump. The water in this well is believed to be faintly chalybeate. The question as to whether this well is at certain times reached by the tide has been matter of dispute. No doubt it is so reached at spring tides. The evidence of an eye witness was to the effect that he had seen it covered by the tide; moreover, I am informed that seaweed has been taken out of the dipping place. The exact depth of the well could not be ascertained.

I consider that all these wells are exposed to great risk of pollution by soakage of foul water, and there can be little doubt that the contained water is at times actually polluted. Although year by year the Medical Officer of Health has called attention to the danger arising from a water supply of this kind, it is an extraordinary fact that the Town Council have never, so far as I could learn, had the water from these wells submitted to an expert for analysis and report. Such very few analyses as I heard of—and only two of these could be traced—were due to private initiation.

*Private Wells.*—But though the public wells are unsatisfactory, the private shallow dry-steined wells are still more so. Sunk in gravel or alluvial soil, it is difficult to see how they can fail to become contaminated. The ground around them, or in their neighbourhood, has for years been polluted by leakage from cesspools (now nearly all abolished), while filth of all kinds thrown upon or dug into the surrounding ground undoubtedly soaks into them. In a great many instances I found these private wells sunk in heavily manured garden land, and their edges flush with the surface of the soil, while in other cases the collar of masonry, or even of decaying woodwork with which wells were furnished, did not prevent the passage of filth directly into the water. An inhabitant assured me that in some parts of “Purewell” it is hardly possible to dig two “spits” deep without meeting with water. A large number of wells are fitted with windlass and chain. Persons drawing water are in the habit of lowering their own pails, a practice which possibly does not always receive the condemnation it deserves.

A few conspicuous examples may be quoted:—

At the National Schools, where at the time of my visit some 380 children were on the books, there is no water supply whatever, either for drinking or washing. I was informed that the children obtain water from the pumps or wells belonging to adjacent cottage dwellings, and, among others, from a dip well adjoining two cottages nearly opposite. This well is sunk in the front kitchen garden, about 15 feet from the front door. The brick collar, which is flush with the ground, had a much-broken wooden cover laid loosely over it. The well is dry-steined, the sides being thickly covered with vegetable growth, owing to free percolation of surface water. The well is about 8 feet deep, and at the time of my visit there appeared to be in it about 2 feet of water. At the bottom of this well, broken pots, tins, and other domestic refuse in variety could be discerned. A number of frogs and toads, some alive and some dead, could also be seen in the water. The water from this well is used for drinking also by the tenants of the cottages in question, who have no other supply. It is noteworthy that at the time of my visit the excrement from the school “latrines,” mixed with earth, was being deposited in a refuse heap only a few yards from this spot.

In the localities known as Whitehall, Silver Street, Fairmile, Soper’s Lane Cottages, Purewell, and at other places, especially objectionable wells were seen: at Purewell, indeed, many wells, I am assured, rise on the occasions of very high tide to a notably higher level.

In some places the tenants reported, as regards their wells, that “there is no water half the time;” “the water comes up thick and muddy;” “the water has worms in it;” “the water is not fit to drink,” &c., &c.

I was told that in the immediate neighbourhood of the “Mill Stream” certain householders at times obtain water for drinking and domestic purposes by dipping from this stream, which receives the discharge of several sewers and house drains.

At Fairmile certain cottages appear to be without any supply at all, thus falling within the scope of Section 62 of the Public Health Act of 1875.

Speaking generally, I may say that I saw very few private wells that ought not, in my opinion, to be forthwith closed. But, as unfortunately is by no means unusual in such cases, not a few persons expressed a prejudice in favour of these local wells, even when, as in two instances at least, they are evidently polluted in a serious manner.

As some decided action in regard to these sources of water supply—public and private—cannot long be delayed, I considered that it behoved me to ascertain broadly the circumstances of the only alternative supply at present afforded, viz., that obtainable from the mains of the West Hants Water Company. Accordingly, I visited the waterworks at Knapp Mill, on the bank of the river Avon, about half a mile from the Town Hall, in company of Mr. Alderman Bemister, the Chairman, and Mr. Sambrooke Newlyn, the Secretary and Manager of the Company, the Medical Officer of Health, and the Surveyor.\*

The West Hampshire Waterworks Company was incorporated by a special Act of Parliament, cited as the “West Hampshire Water Act,” in August, 1893.

The limits of this Act for the supply of water were determined as the township and borough of Christchurch, the parish of Christchurch, and the parishes of Sopley, Ringwood, Milton, Holdenhurst, Brockenhurst, and Lyndhurst, in the county of Southampton. The Company originally spent £1,400 in sinking a cast-iron cylinder well to a depth of 32 ft. 6 in., with two bores at the bottom running to a depth of 144 feet; but the water yielded was uncertain in quality and deficient in quantity, as is frequently found to be the case with wells in the “Bracklesham beds,” and is now only used for condensing purposes. The river Avon, from which the supply is now wholly derived, rises in Wiltshire, in the neighbourhood of Devizes. I do not propose here to deal with pollutions which enter it in the earlier part of its course. On its banks, in the vicinity of Christchurch, are a number of considerable aggregations of population, most of which, as I understand, get rid of their sewage by discharging it more or less directly to the river a few miles above the intake. My inspection of the river did not extend beyond that portion of it in the immediate neighbourhood of the Borough, and hereabouts I noticed that pollution is possible by reason of pig-keeping upon a large scale carried on close to the river about a quarter of a mile above the intake, and from the keeping of animals and poultry by the tenant of the mill at the site of the waterworks.

It is also to be noted that on the Ordnance Survey map (dated June 1872) the highest point indicated as being reached by the tide is at least one-eighth of a mile above the present intake of the Water Company. But the correctness of this was denied, and it appears that there is evidence to support the denial. Moreover, it is contended that in the event of the tide affecting this part of the river, the result would only be to “head back” the fresh water, and that there would be no perceptible saltness. As it is admitted by the governing body of the Water Company that the river Avon is freely polluted by drainage above the intake, it is evident that everything depends upon the sufficient and efficient filtration of the water before its delivery to consumers. It would undoubtedly be desirable that further examination of a minute kind should be made as to pollutions of the Avon. In the Appendix [Appendices III. and IV.] will be found copy of analysis of this water as delivered to consumers, of analysis of the river water taken near the intake at flood time, and also of analysis of water taken when the river was low. I am informed by Mr. Newlyn that the Water Company’s mains are laid down every street in Christchurch, with the exception of Beaconsfield Road (36 houses) and a small street called Avon Buildings.

*Sewerage.*—There is no regular system of sewerage in Christchurch, but I am informed that there are in the district approximately about 4,100 yards of pipe sewer, of very various lengths. I was not able to ascertain the several dates at which these sewers were laid, but it is believed that, except the Stour Road sewer, which was laid in 1893, all were constructed antecedent to 1886. The outfall of this sewer into the river Stour was one of the points named at General Crozier’s inquiry in 1894, already referred to. I am informed that the pipes are of earthenware, the main sewers being 12 in. and the branch pipes 9 in. in diameter. The ventilation of these sewers appears to be inadequate. Road ventilators are placed here and there, as convenient, but the principal means used are ventilating pipes taken up the sides of houses or rising from the kerb line.

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\* NOTE.—A description of the method of filtration, storage, &c., will be found in Appendix III.

I was informed that the whole of the sewers are flushed once a month by the workmen employed by the Town Council. By means of a water cart and hose, with a valve, 18,400 gallons of water taken from the mains of the West Hants Company are on each occasion poured down the sewers.

The gradients of these sewers are in some cases too flat, and I am informed that some of the sewers are rendered still more inefficient owing to catchpits, or intercepting chambers, having been placed in their course. These pits are fitted with removable covers, the idea being, evidently, that solid matter will collect in them, and that this can be emptied out at frequent intervals. The actual result is that the object for which the sewers have been provided, viz., the rapid and complete removal of sewage matters, is not always attained.

As examples of this I may instance the following :—

*Silver Street* (corner of).—An intercepting chamber was opened, and the sewers above the entrance and below the exit exposed. The intercepting chamber is of brick in cement, but not rendered, the bottom being apparently about 18 inches below the level of the bottom of the entering pipe sewer. At the time of my visit there were about nine inches of semi-solid sewage collected here.

*Church Lane* (corner of Silver Street).—This catchpit is provided with a ventilating pipe led up the side of an adjoining house, the finial being within a few feet of the opening of the chimney pots. At the bottom of this catchpit was some excessively offensive solid sewage, about a foot in depth.

From all the sewers, without exception, the sewage is discharged untreated into the rivers Stour and Avon, or into the “Mill Stream,” or into ditches or water-courses connected with them or with the estuary. I am informed that there are eight distinct sewer outfalls. They are as follows :—

Three into the River Stour, viz. :—The Stour road outfall, a short distance below Tuckton Bridge, The Soper’s Lane outfall, near Wick Ferry, and the Quomps sewer outfall.

There are five sewer openings into the “Mill Stream.” Into the river Avon there are various drain openings as well as into ditches communicating therewith.

There is an additional drain into the river Stour from the Artillery Barracks at Porpoise Hill to the N.W. of the town, where about 100 men are quartered. This outfall I visited and observed a quantity of faecal matter flowing upon the water near the opening, and the mud was black and offensive.

All these sewer openings were visited by General Crozier in connection with his inquiry in August, 1894, already referred to. After another inquiry by Mr. Tulloch in October, 1896, also already referred to, an Order declaring the tidal waters of the rivers Stour and Avon above a certain point in “the Run” to be a “stream” within the meaning of the Rivers Pollution Prevention Act of 1876, was issued by the Board on the 4th June, 1897. No action whatever has been taken by the Town Council in consequence of this Order, nor did I hear that any action was contemplated. The sewers and drains continue to discharge their contents into the rivers as before.

I visited the various localities above referred to and found the outfalls to be substantially in the same condition as that described by General Crozier. Around the “Quomps” outfall the river bottom was in a very foul condition, and it is near to this spot that a number of lads are in the habit of bathing.

The outfalls into the “Mill Stream” at the time of my visit did not appear to be discharging very offensive matter, and where the current is swift the water is clear and bright. But where the water is deeper and more sluggish, especially near the Beaconsfield Road outfalls, foul smelling matter and scum had collected in some places. I was informed that at times stench arises from some parts of this stream. Into the Avon close to Waterloo Bridge a drain discharges from an adjacent slaughter-house. On the occasion of my visit a beast had just been killed there, and a stream of blood was flowing into the river from the drain outfall. Eels of considerable size and a quantity of other fish could be seen feeding upon the blood as it flowed.

On either side of the main thoroughfare known as "Purewell," more especially on the side towards the sea, there are a number of so-called tidal ditches which receive the discharges from various short lengths of sewer as well as from house drains and drains from a slaughter-house, cow-houses, piggeries, poultry runs, and the like. This locality is subject to flooding, and at all times these ditches quickly become full of very offensive liquid. As they now are, these ditches constitute a serious nuisance, and a danger to the public health.

As examples, I may instance Clark's ditch and Strong's ditch, both of which contained very foul liquids, the ditch behind Rotten Row, and others, the names of which did not transpire. There are also, in the neighbourhood of Waterloo Bridge, ditches beside, or crossing beneath, the main thoroughfare, which at times are said to be very offensive. There are also various ditches and watercourses on the north side of Bridge Street and Purewell, though at the time of my visit some of these were dry, owing to the extraordinary drought.

All these ditches should at once receive attention. It is a sufficient commentary upon the attitude of the Town Council with regard to the drainage of the district to record the admitted fact that they have never consulted an expert engineer with a view to the devising of some suitable scheme, but continue to plead that their district is a low-lying one, and therefore difficult to deal with, as an excuse for the continuance of the present system, if system it may be called.

During the course of my inspection the following facts came to my knowledge. The adjacent Urban District of Pokesdown, having a population of 2,266 (1891 census), and a rateable value of £17,990, has been for some time constructing, and has now nearly completed, an extensive outfall sewer, the estimated cost of which was £16,500, to take the drainage of the district and discharge it into the sea at a distance of 500 yards from the shore near a point known as "Double Dykes" in the Rural District of Christchurch. This outfall sewer begins as a 4 ft. 0 in.  $\times$  2 ft. 8 in. brick sewer, and continues by a 21 in. rock concrete tube sewer to a 21 in. cast iron outfall. The sewer in its passage by a locality called Tuckton, is within a few hundred feet of the boundary of Christchurch Urban District, which on this side follows the course of the River Stour.

It appears to me to be in the highest degree desirable that the Town Council should, without loss of time, consult some competent engineer with a view to ascertaining whether it would not be possible to profit by the opportunity thus afforded for carrying out a scheme of sewerage for the district, if, as I hope may be the case, terms can be arranged between the Pokesdown Urban District Council and the Corporation of Christchurch. It appears possible that, at a cost considerably less than an entirely separate scheme would entail, a plan could be devised whereby the sewage of Christchurch could be brought to some convenient point, and there lifted into the Pokesdown sewer. I was informed that the Pokesdown sewer has been planned to provide for the requirements of a population of 20,000.

*House drainage.*—From a copy of the report of Mr. Knapp, the then Inspector of Nuisances, after a house-to-house inspection in 1893, I learn that in the month of November of that year there were 151 defective drains in the Borough, of which number 62 needed aerial disconnection, and that 104 were insufficiently ventilated. Since that time considerable efforts have been made in this direction, and though no records of a similar kind appear recently there is no doubt this number has been much reduced.

A number of houses have no slop drains whatever, all liquid wastes being disposed of upon contiguous gardens. In other cases slops are got rid of by pouring into open channels, which I found, in some cases, so much out of repair that foul liquid collected and stagnated therein.

*Excrement and refuse disposal and removal.*—From the report of Mr. Knapp, in 1893, already referred to, I learn that there were at that time 686 earth closets in the district. I was informed that the number is now estimated at 750, or a little more, and that of the 54 cesspit privies which were known to have existed in 1892 it is believed that few, if any, remain, considerable pressure having been brought to bear upon owners of property to abolish them. A number of

houses of the better class are provided with water-closets. Though I was informed that Christchurch was an "earth closet" town, my inspection showed me that the number of instances in which a supply of earth is kept for mixing with excreta is very small indeed, although in the majority of cases galvanized iron pails or other receptacles for excreta are provided beneath the seats. For the removal of excreta the Town Council employ a man at a salary of 27s. per week, notwithstanding their Bye Laws on this subject under Section 44 of the Public Health Act, 1875. He is furnished with an iron tumbler cart, for which he himself, at his own cost, provides the horse. The man thus paid by the Town Council for removing refuse is, in addition, allowed to make his own terms with the inhabitants for emptying their closet pails; a practice which is altogether illegal. From statements made to me, I gather that the cost of this operation varies with the size of houses, but I understood the ordinary tariff to be "one penny per week for two pail emptyings." In default of payment of the sum demanded by him the scavenger may refuse to remove the pail contents, which must then be disposed of by the occupier as he best can. I was informed that the excreta removed were deposited upon agricultural land in various places on the outskirts of, or even beyond, the district. But I found a large heap of house refuse and sweepings in a corner of a field adjoining Wick Lane and very near the National Schools. This work of excreta collection may be performed only until 8 a.m., after which time the man is employed in street scavenging or refuse removal, and it appears that the same cart is used for all purposes. As far as I could learn, in the course of my inspection, the majority of the inhabitants of the working class who possess any garden ground are in the habit, themselves, of emptying their closet pails upon their land. In the majority of the large number of premises visited, I found these pails full to the brim, or even overflowing upon the ground beneath the closet seats. In several instances, the closets were without pails or receptacle of any kind for the excreta, which simply fell upon the ground beneath the seat, forming there a heap which on the occasion of my visit was in some instances considerable. This, I was told by occupiers, was "raked out when necessary," and thrown upon or dug into the garden. In some cases, closet accommodation is insufficient, as well as wholly objectionable. On the premises of a certain unregistered milk-seller, I found that no closet accommodation, in the ordinary sense, existed, but that a portable box convenience was set in a small unventilated entrance lobby adjoining the narrow, dirty passage in which the milk is kept. At the National Schools the arrangement of the latrines is of a peculiar kind. The closets for the boys' and girls' schools are back to back beneath one roof, the opening in the seats communicating with a kind of central chamber common to both sets of closets, and having ventilation in the roof at either gable end. The floor of this species of midden has not been treated in any way. The excreta fall upon the bare ground and, I was informed, the accumulation is removed daily after being mixed with earth. In this process the excreta must be carried through the playground. At the time of my visit, the excreta thus removed that morning had been deposited upon a large and rapidly growing heap of refuse on the opposite side of the road, about 50 feet from the infant school-house. The iron tumbler cart, whose diverse uses have already been referred to, is also kept at this spot. Near the centre of the town I found that the drainage of three or four houses, including one water-closet at least, is conveyed by a drain, furnished with a catchpit for the interception of solids, to a large open "sump" hole in a kitchen garden near the bottom of an adjacent slope. At the date of my visit this "sump" hole was quite full of thick, stinking liquid from which bubbles of gas were arising. The hole is provided with an iron pump, which had, it was stated, to be used daily to prevent overflow.

Although in some outlying localities some householders undoubtedly dispose of their house refuse by throwing it upon the ground, much of the Borough refuse seems to be removed by the agency of the Town Council, as already described. At the time of my visit I saw but few accumulations of house refuse, but in many places there were accumulations of manure, especially pig manure.

I am informed that there are no *common lodging houses* in the district.

There are five registered *slaughter-houses* in Christchurch. On the occasion of my visit they were, as regards actual tidiness, in a fairly satisfactory condition, but in several cases the flooring was defective and ventilation was insufficient. The arrangements for the disposal of blood and offal were not good. I have already referred to one instance in which I saw blood draining to the river Avon. In another there was a drain to a ditch. Adjoining one slaughter-house was a "hand flushed" water-closet, which urgently needed flushing. Generally the slaughter-houses are situate in too confined a space and are too close to dwelling houses.

There are ten registered *cowsheds, dairies, and milkshops*. In most cases only a few cows are kept, but generally the cow-houses were in a condition that showed neglect. Serious danger to milk consumers is incurred in many instances by the washing of milk vessels with water from shallow surface wells liable to pollution, and the keeping of milk in small ill-ventilated apartments adjoining, and in some cases almost forming part of living rooms, and adjacent to ill-kept pail closets. These matters obviously need immediate attention.

At the time of my visit there were fourteen registered *bakehouses*. They were in many instances not too cleanly, and, in most, water appeared to be drawn from wells of the usual type—and in some instances these wells were among the worst met with.

I heard of no offensive trades carried on in the Borough, but much nuisance is undoubtedly caused by pig keeping. In some cases, and those in the vicinity of the main street, pigs are kept in considerable number. I have already referred to the extraordinary drought prevailing during and for a long time previous to my inspection; this condition rendered it difficult to gauge accurately the extent of the nuisance arising in normal times from this extensive practice. The duty of the District Council in dealing with such nuisances is clearly pointed out in Section 47 of the Public Health Act, 1875.

#### B.—SANITARY ADMINISTRATION.

The sanitary administration of Christchurch has been in the hands of a Town Council since 1886, prior to which year the town was included in the Christchurch Rural District. The Town Council number sixteen members, and their meetings are held monthly. The Committees concerned with matters dealing with public health are (1) the Sanitary Committee and (2) the Roads and Pleasure Grounds Committee. These Committees meet at fortnightly and monthly intervals respectively and make their reports and recommendations to the Town Council. I am informed that the Sanitary Committee can authorize their officers to give notices, etc., but if it were necessary that proceedings should be taken the matter would, in the first instance, be referred to the Town Council. The following voluntary Acts dealing with sanitary matters have been adopted, and are now in force in the Borough: "The Infectious Disease (Notification) Act, 1889," adopted on the 1st of January 1890; "The Infectious Disease (Prevention) Act, 1890," adopted on the 15th January 1891; "The Public Health Acts Amendment Act, 1890," adopted on the 18th December, 1890. There are no bye-laws framed under this Act, and no action has been taken under "The Housing of the Working Classes Act, 1890."

There are bye-laws for the Borough of Christchurch allowed by the Local Government Board on the 15th December, 1887, in regard of the following matters:—

1. { The Cleansing of Footways and Pavements.  
The Removal of House Refuse.  
The Cleansing of Earth Closets, Privies, Ashpits, and Cesspools.
2. Nuisances.
3. Common Lodging Houses.
4. Slaughter Houses.
5. New Streets and Buildings. (Several clauses of these are, I understand, under revision.)

In March, 1889, and March, 1891, the Board also sanctioned bye-laws with respect to the Recreation Ground, near Barrack Road and the Castle Hill, and the Recreation Ground at Stanpit, respectively.

The *Medical Officer of Health* is Mr. Robert Lloyd Legate, L.R.C.P. & L.R.C.S. Edin., who was appointed in November, 1888. He receives an annual salary of £30, a moiety of which is repayable from County funds. He is in active private practice. He also holds the posts of Medical Officer of Health to the Christchurch Rural District, and District Medical Officer and Public Vaccinator of the 2nd District of the Christchurch Union. He has a good knowledge of his district, and is keenly alive to its wants. In his Annual Reports he has regularly, in general though distinct terms, called attention to the dangerous water supply, the defective disposal of excrement, and the want of means of isolation, disinfection, and other matters.

The *Inspector of Nuisances* is Mr. E. I. Legg, who receives an annual salary of £70 in this capacity, a moiety of which is repayable from County funds. He holds in addition to his Inspectorship the offices of Surveyor, Municipal Surveyor, Collector, and School Attendance Officer. Previous to his appointment he was for some years Assistant Surveyor to the Gosport and Alverstoke Urban District Council. Having been appointed to the Christchurch District only a few months ago, it is too soon, as yet, to estimate the value of the work done by him. He appeared to me to be capable and willing. In my opinion, formed as the result of my inspection of the Borough, it is undesirable that the post of Collector, which makes large demands upon the holder's time, should be combined with that of Surveyor and Inspector of Nuisances. There are six other men in the employ of the Town Council at wages of from 15s. to 27s. per week.

The district possesses no isolation hospital. A Berthon tent was purchased in 1894, during a small-pox scare, and has, I understand, never been used. There is no disinfecting apparatus whatever. The duty of disinfection is thrown upon private individuals, and is generally performed in an unsatisfactory manner. As already stated, the need of means of disinfecting clothing, bedding, &c., has repeatedly been insisted upon by the Medical Officer of Health.

From what has been already said, it will have been seen that the sanitary condition of the Borough of Christchurch is exceedingly unsatisfactory, and that the Town Council have taken no action of a comprehensive kind with regard to dangerous defects existing therein. Speaking generally it appears to me, as the result of my inspection, that the Town Council are fairly prompt to act in minor matters, but dilatory and procrastinating in their dealing with large and pressing questions, and with recurring nuisances. The questions of water supply, sewerage and drainage, and excrement disposal, require immediate attention.

It is true that in some cases the Town Council have been concerned with extensions or alterations of existing sewers, but, as I have said, no serious attempt has been made, not even to the extent of consulting an expert engineer, to ascertain the best means of providing an efficient scheme of sewerage.

The expense of such a scheme will undoubtedly be considerable, inasmuch as whatever form this may take, and whether or not it be found to be permissible to utilise the convenient proximity of the new Pokesdown outfall sewer, pumping must inevitably form an essential feature. On the other hand, it must be borne in mind that the Borough is at present free from debt. My inquiries also tended to convince me that a large section of the inhabitants are aware that the difficulty must now be faced, and would welcome a means of escape from much annoyance.

In a similar manner there has been no earnest endeavour, so far as I can discover, to meet the question of a wholesome water supply. This is the more strange, inasmuch as on the 5th October, 1893, the Town Council, by public

circular, advised the inhabitants of the Borough to boil and filter all the water used by them for drinking purposes. (A copy of this circular will be found in Appendix II.) I ascertained that this public notice was issued in consequence of alarm caused by the report of Dr. Dupré, already referred to, upon the water of the High Street pump. I was unable to learn at what subsequent date it was considered that this water had again become wholesome ; the well is, as regards liability to pollution, in the same condition now as it was at the time the analysis was made.

It is possible that the Town Council may have hesitated to order the closure of the present public and other wells, inasmuch as this measure would necessitate the provision, by the Town Council or by private owners, of a supply from the mains of the West Hants Water Company, the only possible alternative, and it is generally understood that several members of the Town Council are financially interested in the undertaking. But the duty of the Town Council, undoubtedly, is to take highly skilled advice as to the quality of the water thus provided.

In addition to those larger questions there is need for vigilance in enforcing the Borough Bye-laws as regards slaughter-houses.

The Dairies, Cowsheds, and Milkshops Order needs to be put vigorously in force, and care should be taken that no milk vendors escape registration.

It is also necessary that the Town Council ascertain without delay how they may, either alone or in combination with some neighbouring district or districts, provide a suitable hospital for the isolation of persons suffering from infectious disease. An apparatus for the efficient disinfection of clothes and bedding, the want of which has been long felt, should also be provided.

Moreover, considering the singularly picturesque situation and character of the town, and the many advantages it offers to visitors, it may be reasonably expected that the increased numbers attracted to the place will in large, if not in full measure, compensate hereafter for expense incurred in providing essentials to the maintenance of the public health.

To Mr. John Druitt, the Town Clerk, I have to express my thanks for help at all times readily afforded. My thanks are also tendered to Mr. Sambrooke Newlyn, the Secretary and Manager of the West Hants Water Company, for the description of the Company's source of supply, method of filtration, storage, &c., which will be found in the Appendix, as well as for the loan of maps, plans, and such like. I am also especially indebted to Mr. Lloyd Legate, the Medical Officer of Health, and to Mr. Legg, the Surveyor and Sanitary Inspector, from both of whom I derived much help.

F. ST. GEORGE MIVART.

October, 1898.

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Copy of analysis of water from pump in High Street.

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### APPENDIX No. II.

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| C. | " " " " "                                                                                                                                  | ...    |  | (December 16, 1896). |
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### APPENDIX No. IV.

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MAP Showing the Christchurch Urban District and the Adjacent Sanitary Area's of Christchurch Rural and Pokesdown Urban.  
Boundaries of areas shown by Pink and Brown lines. Pokesdown Outfall Sewer shown by Red line.

Scale 3 Inches to One Mile.





## APPENDIX I.

*“19th October, 1893, Sample from Public Pump in High Street, Christchurch, near junction of High Street and Crisple Street.”*

The water is bright, yields no deposit on standing, and is inodorous. It is, however, very largely polluted by sewage, and is totally unfit for drinking or other domestic purposes.

### *Analytical Details.*

|                         |     |     |     |     |                           |
|-------------------------|-----|-----|-----|-----|---------------------------|
| Appearance ...          | ... | ... | ... | ... | Bright.                   |
| Colour ...              | ... | ... | ... | ... | Pale yellowish.           |
| Smell ...               | ... | ... | ... | ... | Inodorous.                |
| Deposit ...             | ... | ... | ... | ... | None.                     |
| Nitrous acid ...        | ... | ... | ... | ... | None.                     |
| Phosphoric acid ...     | ... | ... | ... | ... | <i>Very large amount.</i> |
| Poisonous metals        | ... | ... | ... | ..  | None.                     |
| Hardness before boiling | ... | ... | ... | ... | 21·6 degrees, Clark.      |
| „ after „               | ... | ... | ... | ... | 12·0 „ „                  |

### *Grains per gallon.*

|                                      |     |                                                         |
|--------------------------------------|-----|---------------------------------------------------------|
| Oxygen absorbed from permanganate... | ... | 0·09.                                                   |
| Total dry residue...                 | ... | 56·84.                                                  |
| Colour of residue...                 | ... | Pale brownish.                                          |
| Behaviour of residue on ignition     | ... | Blackens very strongly, burns off with some difficulty. |
| Chlorine ...                         | ... | 9·73.                                                   |
| Nitric acid ...                      | ... | 6·99.                                                   |
| Ammonia ...                          | ... | 0·0007.                                                 |
| Albuminoid ammonia ...               | ... | 0·0093.                                                 |

(Signed) A. DUPRÉ.

Medical School,  
Caxton Street, Westminster,  
October 23rd, 1893.

## APPENDIX II.

### BOROUGH OF CHRISTCHURCH.

At a meeting of the Town Council of the above Borough, held on Friday, 29th September, 1893, it was resolved that the people residing in the Borough should be advised, by circular, to boil and filter all the water which they use for drinking purposes.

You are hereby advised accordingly.

JOHN DRUITT,  
Town Clerk.  
*By Order of the Council.*

5th October, 1893.

APPENDIX III.

A.

DESCRIPTION OF WEST HANTS WATER COMPANY'S PLANT AND ARRANGEMENTS FURNISHED BY MR. SAMBROOKE NEWLYN, SECRETARY AND MANAGER.

WEST HAMPSHIRE WATER COMPANY, CHRISTCHURCH.—PARTICULARS AND SOURCE OF SUPPLY, FILTRATION, STORAGE, &C.

Source. The source from which the water is obtained is the river Avon, at a point specified in the Company's Act, 1893, clause.30.

Means of abstraction from river. The water is admitted through a fine gauze wire to a covered sunk tank in a chamber constructed by the side of the river about 7 feet in depth.

Course of water. Into the before-mentioned chamber the suction of the low lift pumps is introduced. These pumps take up the water and carry it to an overhead tank in the clarifier house.

Clarifier house and clarifiers. This building contains four Candy's patent clarifiers, which may be used either separately or collectively as required.

Straining or clarifying process. Each clarifier is composed of a square tank, covered, having about 10 inches from the bottom a plate perforated with  $\frac{1}{32}$ -inch holes extending over its whole area. On this plate rests a layer of burnt ironstone about the size of nuts ; above this is another layer about pea size ; overlaying this is about 15 inches polarite overlaid by coarse grit, again overlaid by fine sand. These tanks are connected on the north side with the overhead tank (elevated about 10 feet) from which the water passes into the top of the clarifiers and by the overhead pressure is forced through the filtrant into the bottom chamber of the clarifiers. This has removed all the river debris, &c., and the filtered or clarified water is now passed on through a distribution pipe running the whole length of the filter beds, over which it is distributed in a fine spray through inverted cones having holes  $\frac{1}{32}$  of an inch in diameter, thus assuring perfect aeration.

Aeration. The filter beds over which the water is thus distributed are composed of the following ingredients :—

|           |     |     |                                    |
|-----------|-----|-----|------------------------------------|
| 1st layer | ... | ... | 4 ins. fine sand.                  |
| 2nd „     | ... | ... | 4 ins. fine grit.                  |
| 3rd „     | ... | ... | 4 ins. coarser grit.               |
| 4th „     | ... | ... | 3 ft. 6 ins. polarite.             |
| 5th „     | ... | ... | 3 ins. coarse grit.                |
| 6th „     | ... | ... | 3 ins. pea gravel.                 |
| 7th „     | ... | ... | Drainage material and drain pipes. |

Clear-water or finished water chambers. The water having filtered through this material is conducted into clear-water chambers constructed on the south side of the filter beds into which it flows through a valve at the bottom of chamber.

Course to high lift pumps. The finished water is now conducted to a reservoir lined with white tiles, immediately below the high lift pumps, which take it up and pass it into the mains either direct to the consumer or to the reservoir, which contains only filtered water.

Reservoir (open). The reservoir, built of concrete, is situate at St. Catherine's (or Kaltern's) Hill, about 1 mile distant, at an elevation of about 150 feet above the town. This reservoir holds only 140,000 gallons, and is intended simply to hold one day's supply when the district is fully supplied.

The Company, however, have two acres of land in addition on the site to build a larger reservoir when required. The reservoir is emptied and cleaned once a month during the summer.

Water tower at Southbourne. The Company also have a brick-built water tower at Southbourne, with a covered iron tank holding 30,000 gallons, for the supply of Southbourne district. The delivery from the high lift pumps is simultaneous through the same main, a part branching off to Southbourne, the remainder going to reservoir of Kaltern's Hill.

Service. The service is constant, night pressure equal to 150 feet head, day pumping pressure equal to 220 to 280 feet head.

Analysis. Dr. Angell (the County Analyst), Norham Lodge, Shirley, Southampton, collects samples, inspects works, and makes monthly analysis ; and reports for the Company analysis have also been made by Professor J. Attfield and Mr. George Brownen.

The Government authorities at Netley also make occasional analysis of the water, the Christchurch Artillery Barracks, as also the two Coastguard Stations being supplied by the Company. In every case, both chemically and bacteriologically, the water has been found satisfactory.

METHOD OF CLEANING.

Clarifier. The overhead tank is divided into two sections, the *northern* section receiving the river water for clarification.

The *southern* section being connected with the rising main is supplied with filtered water from the reservoir.

By reversing the valves attached to the clarifiers at the close of the day's pumping a reverse stream of filtered water is passed upwards through the clarifiers, and the contents are thus washed and the washing discharged through a pipe leading into a lower portion of the river in a separate mill leat from the intake. This can be done as often as required and when the river is dirty after heavy rains one section of the clarifier is always being cleansed whilst the remaining three are at work.

Cleansing.  
Continuous cleansing.

The filter beds are arranged in pairs, each pair having a separate clear-water chamber and each bed having a separate valve governing its flow into the chamber.

Filter beds.

On the north side is a draw-off pipe on the level of the sand. Stretching across the beds on the level of the sand and communicating with the draw-off pipe by a valve is an iron channel. The water is first drawn off one of the beds (by opening this valve) to the level of the sand, then the valve communicating with the clear-water chamber is opened and the filtered water from the other bed, the water of which is at a higher level, passes upwards and removes the deposit left on the top layer of the sand (a man agitating the surface of the sand meanwhile). The deposit is then conveyed by a waste pipe to the waste mill leat. This operation can be performed as often as required, but is regularly done once a week, so that a continual cleansing of the filtrant is maintained.

Cleansing.

As a result, after twelve months' work, when the polarite was uncovered (and the whole top layers removed) it was found that the polarite was unsoiled and that no dirt had penetrated more than 2 or 3 inches into the top layers.

Result.

The Company spent £1,400 in sinking a cast-iron cylinder well down to the layer of clay 32 ft. 6 in. below surface, the bottom of which was concreted 5 ft. Two bores, one 6 in. one 4 in., were continued through the bottom to a depth of 144 feet, but the water obtainable was found to be of uncertain quality and deficient in quantity, the Company, therefore, only make use of this water for condensing purposes for their engines, and have a small 2 in. suction into it for that purpose.

Well.

SAMBROOKE NEWLYN,  
Manager and Secretary,

September 6, 1898.

B.

Hants County Laboratory,  
Southampton,  
August 12th, 1895.

To the West Hampshire Water Company, Christchurch.

*Analysis of, and Report on, a Sample of Water received on 5th August, 1895.*  
*Description of Sample.*

No. 1 Sample of water taken from River Avon at site of intake of West Hants Water Company at 12 noon, August 3rd, 1895.

State of river, three parts flood after heavy rains. Large amount of weed cutting.

*Physical Properties.*

|                                         |     |     |     |     |                         |
|-----------------------------------------|-----|-----|-----|-----|-------------------------|
| Colour at a depth of 2 feet             | ... | ... | ... | ... | Yellow                  |
| Smell when heated                       | ... | ... | ... | ... | Strongly, river like.   |
| Appearance of residue after evaporation | ... | ... | ... | ... | Rather dirty.           |
| Turbidity                               | ... | ... | ... | ... | Fairly bright.          |
| Suspended matter                        | ... | ... | ... | ... | Considerable traces of. |

*Chemical Analysis.*

|                                                | Expressed in parts<br>per hundred<br>thousand. | Expressed in<br>grs. per<br>Gallon. |
|------------------------------------------------|------------------------------------------------|-------------------------------------|
| I.—Free ammonia                                | ·0206                                          | ·0144                               |
| II.—Albuminoid ammonia                         | ·0207                                          | ·014                                |
| Equal to nitrogen obtained from organic matter | ·01704                                         | ·01192                              |
| III.—Nitrogen present as nitrates and nitrites | ·0905                                          | ·0633                               |
| Total Nitrogen (in I., II., and III.)          | ·1245                                          | ·08715                              |
| IV.—Chlorine                                   | 1·46                                           | 1·02                                |
| Calculated as common salt                      | 2·40                                           | 1·68                                |
| V.—Phosphoric acid                             | Very slight trace.                             | —                                   |
| VI.—Poisonous metals                           | Not any.                                       | —                                   |
| VII.—Total Solids dried at 212 deg. F.         | 26·0                                           | 18·2                                |
| Oxygen absorbed in 15 minutes at 80 deg. F.    | ·105                                           | ·0735                               |
| Oxygen absorbed in 4 hours at 80 deg. F.       | ·170                                           | ·119                                |

*Hardness by Clark's Scale.*

Total hardness, 11·3 deg. ... } Fixed, 4·0 deg.  
Removable by boiling, 7·3 deg.

*Behaviour of Residue on Ignition.*

Darkened considerably ; emitted much odour of burning organic matter (vegetable).

*Microscopical Examination.*

Broken up vegetable matter (organisms usual to river waters)—algæ—diatoms.

*Report.*

It is highly satisfactory to note that, notwithstanding the flooded state of the river, the water is in good condition and quite fit for drinking purposes.

ARTHUR ANGELL,  
Public Analyst.

Dated 12th day of August, 1895.

C.

Hants County Laboratory,  
Southampton,  
December 16th, 1896.

To the West Hants Water Company.

*Analysis of, and Report on, a Sample of Water collected on the  
9th December, 1896, by self.*

*Description of Sample.*

River water before filtration.

*Physical Properties.*

|                                         |     |     |     |     |               |
|-----------------------------------------|-----|-----|-----|-----|---------------|
| Colour at a depth of 2 feet             | ... | ... | ... | ... | Deep yellow.  |
| Smell when heated                       | ... | ... | ... | ... | Weedy.        |
| Appearance of residue after evaporation | ... | ... | ... | ... | Discoloured.  |
| Turbidity                               | ... | ... | ... | ... | A noticeable. |
| Suspended matter                        | ... | ... | ... | ... | Considerable. |

*Chemical Analysis.*

|                                                   | Expressed in parts<br>per hundred<br>thousand. | Expressed in grs.<br>per Gallon. |
|---------------------------------------------------|------------------------------------------------|----------------------------------|
| I.—Free ammonia                                   | ·02                                            | ·014                             |
| II.—Albuminoid ammonia                            | ·029                                           | ·0203                            |
| Equal to nitrogen obtained from organic matter    | ·0238                                          | ·0166                            |
| III.—Nitrogen present as nitrates and nitrites... | ·2222                                          | ·1555                            |
| Total nitrogen (in I., II., and III.)             | ·2624                                          | ·1836                            |
| IV.—Chlorine                                      | 1·46                                           | 1·02                             |
| Calculated as common salt...                      | 2·4                                            | 1·68                             |
| V.—Phosphoric acid                                | Very slight                                    | trace of.                        |
| VI.—Poisonous metals                              | None.                                          | —                                |
| VII.—Total solids dried at 212 deg. F.            | 26                                             | 18·2                             |
| Oxygen absorbed 15 minutes, 80 deg. F....         | ·145                                           | ·1015                            |
| “ “ 4 hours “ “ ...                               | ·26                                            | ·182                             |

*Hardness by Clark's Scale.*

Total hardness, 9·6 degrees ... { Fixed, 3·3 degrees.  
Removable by boiling, 6·3 degrees.

*Behaviour of Residue on Ignition.*

Darkened considerably. Odour of burning vegetable matter. Carbon rapidly oxidised.

*Microscopical Examination.*

Vegetable debris ; muddy particles, micrococci, diatoms ; ciliated and other organisms common in river waters.

Report.

The river being now in flood, the water is charged with floating particles. On examination this matter is found to be entirely normal river debris. It is also strongly coloured with peaty infusion. There is no evidence of pollution.

Dated December 16th, 1896. ARTHUR ANGELL, Public Analyst.

D.

Hants County Laboratory,  
Southampton,  
16th December, 1896.

To the West Hants Water Company.

Analysis of, and Report on, a Sample of Water collected on the 9th December, 1896, by self.

Description of Sample.

Filtered water from pure water chamber.

Physical Properties.

|                                         |     |     |     |     |     |                 |
|-----------------------------------------|-----|-----|-----|-----|-----|-----------------|
| Colour at a depth of 2 feet             | ... | ... | ... | ... | ... | Colourless.     |
| Smell when heated                       | ... | ... | ... | ... | ... | Not noticeable. |
| Appearance of residue after evaporation | ... | ... | ... | ... | ... | Fairly clean.   |
| Turbidity                               | ... | ... | ... | ... | ... | Bright.         |
| Suspended matter                        | ... | ... | ... | ... | ... | Nil.            |

Chemical Analysis.

|                                                | Expressed in parts per hundred thousand. | Expressed in grs. per Gallon. |
|------------------------------------------------|------------------------------------------|-------------------------------|
| I.—Free Ammonia                                | ·0064                                    | ·00448                        |
| II.—Albuminoid Ammonia                         | ·0138                                    | ·00966                        |
| Equal to Nitrogen obtained from Organic Matter | ·0113                                    | ·00791                        |
| III.—Nitrogen present as Nitrates and Nitrites | ·2139                                    | ·1497                         |
| Total Nitrogen (in I., II., and III.)          | ·2305                                    | ·16135                        |
| IV.—Chlorine                                   | 1·5                                      | 1·05                          |
| Calculated as Common Salt                      | 2·47                                     | 1·72                          |
| V.—Phosphoric Acid                             | Very slight trace                        | —                             |
| VI.—Poisonous Metals                           | Not any                                  | —                             |
| VII.—Total Solids dried at 212 deg. F.         | 22·4                                     | 15·68                         |
| Oxygen absorbed 15 min. } 80 deg. F....        | ·07                                      | ·049                          |
| „ „ 4 hours }                                  | ·1225                                    | ·0857                         |

Hardness by Clark's Scale.

|                          |     |     |     |     |                                |
|--------------------------|-----|-----|-----|-----|--------------------------------|
| Total hardness, 9·6 deg. | ... | ... | ... | ... | Fixed, 3·3 deg.                |
|                          |     |     |     |     | Removable by boiling, 6·3 deg. |

Behaviour of Residue on Ignition.

Satisfactory.

Microscopical Examination.

Satisfactory.

Report.

Seeing that the river on this date was in a highly flooded state, it is gratifying to find that there is no change in the filtered water as supplied to the public.

This water in appearance and in purity is all that can be desired.

Dated 16th day of December, 1896. ARTHUR ANGELL,  
Public Analyst.

E.

Reference No. E. 24. 38, Gloucester Place,  
Boscombe, Bournemouth, Hants,  
November 17th, 1897.

Certificate of Water Analysis.

Sample marked, "Service Water from tap in private house."  
Taken by Geo. Brownen, from S. Newlyn, Esq., Stour Road, Christchurch, Hants.

Results of Analysis.

|                                                                                                      | No. 1.<br>Nov. 17th, 1897. | No. 2.<br>July 15th, 1898. |
|------------------------------------------------------------------------------------------------------|----------------------------|----------------------------|
| Physical Characteristics—                                                                            |                            |                            |
| Colour when examined in a tube two feet long...                                                      | Pale straw yellow          | Very pale straw yellow.    |
| Suspended matter ... ..                                                                              | Minute and granular.       | (same).                    |
| Smell when heated to 100 deg. F....                                                                  | None.                      | None.                      |
| Taste do. do. ... ..                                                                                 | None.                      | None.                      |
| Hardness before boiling, 12·5°; after boiling, 6°, Clark's scale.                                    | —                          | —                          |
| Chemical Results—                                                                                    | Grains per gall.           | Grains per gall.           |
| Total solid matter ... ..                                                                            | 19·62                      | 22·12                      |
| Loss on ignition after deducting combined carbonic acid.                                             | —                          | —                          |
| Total mineral matter ... ..                                                                          | —                          | —                          |
| Chlorine—equal to chloride of sodium ... ..                                                          | 1·10                       | ·94                        |
| Lead and copper, none; iron ... ..                                                                   | Traces.                    | A trace.                   |
| Lime ... ..                                                                                          | —                          | —                          |
| Magnesia ... ..                                                                                      | —                          | —                          |
| Alkaline salts... ..                                                                                 | —                          | —                          |
| Sulphuric acid ... ..                                                                                | —                          | —                          |
| Phosphoric acid ... ..                                                                               | A slight trace.            | A mere trace.              |
| Nitrites ... ..                                                                                      | None.                      | None.                      |
| Nitrogen as Ammonia ... ..                                                                           | ·001                       | ·000                       |
| „ „ Albuminoid Ammonia ... ..                                                                        | ·007                       | ·007                       |
| „ „ Nitrates... ..                                                                                   | ·019                       | ·095                       |
| Oxygen absorbed by organic matter from solution of permanganate of potash. } at 80 deg. F. in 2 min. | ·003                       | ·002                       |
| „ „ „ „ „ in 4 hrs.                                                                                  | ·102                       | ·106                       |
| Earthy matters, etc....                                                                              | —                          | Insignificant.             |

Microscopical Results—  
Unimportant and satisfactory.  
Bacteriological examination also satisfactory.  
It was a pure or potable water free from contamination (with the exception of a little iron probably derived from piping) and suitable for drinking or other domestic uses.

GEORGE BROWNEN, F.C.S.

Report, July 15th.—It was a sample of moderately hard and pure water fit for drinking purposes or other domestic use.

GEORGE BROWNEN, F.C.S.

F.

Hants County Laboratory,  
Southampton,  
January 31st, 1898.

To the West Hants Water Company.

Analysis of, and Report on, a Sample of Water received on the 24th January, 1898.

Description of Sample.

“Sample of water from mains of West Hampshire Water Company. January 24th, 1898.” S. NEWLYN, Secretary.”

Physical Properties.

|                                                |                 |
|------------------------------------------------|-----------------|
| Colour at a depth of 2 feet ... ..             | Colourless.     |
| Smell when heated ... ..                       | Not noticeable. |
| Appearance of residue after evaporation ... .. | Clean.          |
| Turbidity ... ..                               | Bright.         |
| Suspended matter ... ..                        | None.           |

Chemical Analysis.

|                                                                                                                     | Expressed in parts<br>per hundred<br>thousand. | Expressed in grs.,<br>per Gallon. |
|---------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-----------------------------------|
| I.—Free ammonia ... ..                                                                                              | Not any.                                       | —                                 |
| II.—Albuminoid ammonia ... ..<br>Equal to nitrogen obtained from organic matter.                                    | ·0088                                          | ·00616                            |
| III.—Nitrogen present as nitrates and nitrites ... ..<br>Total nitrogen (in I., II., and III.) ... ..               | ·2452<br>—                                     | ·1716<br>—                        |
| IV.—Chlorine ... ..<br>Calculated as common salt ... ..                                                             | 1·46<br>2·4                                    | 1·02<br>1·68                      |
| V.—Phosphoric acid ... ..                                                                                           | Slight trace of.                               | —                                 |
| VI.—Poisonous metals ... ..                                                                                         | Not any.                                       | —                                 |
| VII.—Total solids dried at 212 deg. F. ... ..<br>Oxygen absorbed, 15 min. 80 deg. F. ... ..<br>" " 4 hours " ... .. | 28·4<br>·0325<br>·058                          | 19·88<br>·02275<br>·0406          |

Hardness by Clark's Scale.

Total hardness, 10·8 deg. ... .. { Fixed, 4·3 deg.  
Removable by boiling, 6·5 deg.

Behaviour of Residue on Ignition.

Darkened slightly. Odour burning vegetable matter. Very slight.

Microscopical Examination.

Very satisfactory.

Report.

This water is an excellent one for a public supply ; it is bright, brisk, well oxidised and quite colourless.

The constancy in the character of this water, year after year, at the same season, is a very valuable property.

ARTHUR ANGELL, Public Analyst.

Dated 31st day of January, 1898.

G.

Hants County Laboratory,  
Southampton,  
29th July, 1898.

To the West Hants Water Company.

Analysis of, and Report on, a Sample of Water received 26th July, 1898.

Description of Sample.

“Sample of water from consumer's tap, West End, Christchurch, taken July 26th, at 12 noon, by George Marshall. S. NEWLYN, Sect.”

Physical Properties.

|                                                |                       |
|------------------------------------------------|-----------------------|
| Colour at depth of 2 feet ... ..               | Faint yellowish tint. |
| Smell when heated ... ..                       | Not noticeable.       |
| Appearance of residue after evaporation ... .. | Fairly clean.         |
| Turbidity ... ..                               | Bright and clear.     |
| Suspended matter ... ..                        | Scarcely a trace of.  |

Chemical Analysis.

|                                                                            | Expressed in parts per<br>hundred thousand. | Expressed in<br>grs. per Gallon. |
|----------------------------------------------------------------------------|---------------------------------------------|----------------------------------|
| Free Ammonia ... ..                                                        | Not any.                                    | —                                |
| Albuminoid Ammonia ... ..                                                  | ·0124                                       | ·00868                           |
| Oxygen absorbed in 15 minutes at 80 deg. F. ... ..<br>" " 4 hours " ... .. | ·0525<br>·0975                              | ·03675<br>·06825                 |
| Nitrogen present as Nitrates and Nitrites ... ..                           | ·0559                                       | ·0391                            |
| Chlorine ... ..                                                            | 1·44                                        | 1·00                             |
| Calculated as Common Salt ... ..                                           | 2·37                                        | 1·65                             |
| Phosphoric Acid ... ..                                                     | A slight trace of.                          | —                                |
| Poisonous Metals ... ..                                                    | Not any.                                    | —                                |
| Total solids dried at 212 deg. F. ... ..                                   | 24                                          | 16·8                             |

*Hardness by Clark's Scale.*

|                           |     |     |     |   |                                |
|---------------------------|-----|-----|-----|---|--------------------------------|
| Total Hardness, 11.6 deg. | ... | ... | ... | { | Fixed, 6.1 degrees.            |
|                           |     |     |     | { | Removable by boiling, 5.5 deg. |

### Behaviour of Residue on Ignition.

Darkened slightly. Slight odour of burning vegetable matter.

*Microscopical and Biological Examination.*

Satisfactory.

*Report.*

On comparing with last month's figures it will be seen that the water is remarkably constant in its character. It is in good condition.

ARTHUR ANGELL,  
Public Analyst.

Dated 29th day of July, 1898.

## H.

Hants County Laboratory,  
Southampton,

To the West Hampshire Water Company.

6th September, 1898.

*Analysis of, and Report on, a Sample of Water received on the 26th August, 1898.*

*Description of Sample.*

Sample of water from Consumer's tap, 16, Stour Road, Christchurch, taken by S. Newlyn, August 26th, 3.30 p.m.

*Physical Properties.*

|                                         |     |     |     |     |     |                   |
|-----------------------------------------|-----|-----|-----|-----|-----|-------------------|
| Colour at a depth of 2 feet             | ... | ... | ... | ... | ... | Colourless.       |
| Smell when heated                       | ... | ... | ... | ... | ... | Not noticeable.   |
| Appearance of residue after evaporation |     |     | ... | ... | ... | Fairly clean.     |
| Turbidity                               | ... | ... | ... | ... | ... | Bright and clear. |
| Suspended matter                        | ... | ... | ... | ... | ... | Practically none. |

### Chemical Analysis.

|                                                          | Expressed in parts<br>per hundred<br>thousand. | Expressed in<br>grs. per Gallon. |
|----------------------------------------------------------|------------------------------------------------|----------------------------------|
| Free ammonia ... ..                                      | ·002                                           | ·0014                            |
| Albuminoid ammonia... ..                                 | ·0082                                          | ·00574                           |
| Oxygen absorbed in 15 minutes at 80 deg. F. ... ..       | ·058                                           | ·0406                            |
| "          "          4 hours          "          ... .. | ·111                                           | ·0777                            |
| Nitrogen present as nitrates and nitrites ... ..         | ·023                                           | ·0161                            |
| Chlorine ... ..                                          | 1·7                                            | 1·19                             |
| Calculated as common salt ... ..                         | 2·8                                            | 1·96                             |
| Phosphoric acid ... ..                                   | Traces of.                                     | —                                |
| Poisonous metals ... ..                                  | Not any.                                       | —                                |
| Total solids dried at 212 deg. F. ... ..                 | ·24                                            | 16·8                             |

*Hardness by Clark's Scale.*

Total hardness, 11·8 degrees      ...      ...  $\left\{ \begin{array}{l} \text{Fixed, 5·5 deg.} \\ \text{Removable by boiling, 6·3 deg.} \end{array} \right.$

### Behaviour of Residue on Ignition.

Darkened somewhat. Slight odour of burning vegetable matter.

Microscopical and Biological Examination, highly satisfactory.

*Report.*

This water is in excellent condition in every respect.

ARTHUR ANGELL,  
Public Analyst.

Dated 6th day of September, 1898.

## APPENDIX IV.

## A.

Copy of letter sent to Dr. Angell on September 26th 1898, accompanying sample of crude water from the river Avon at the West Hampshire Water Company's intake.

Christchurch,  
26th September, 1898.

Dear Sir.—Dr. Mivart, Local Government Board Inspector, who has had our analyses before him, including samples of the natural water at flood time, has asked for one when the river is exceptionally low.

As it is now lower than it has been for very many years, I have taken a sample at the intake this morning, which I have despatched by rail to you. Kindly forward me your report on same, as early as possible, and oblige,

Dr. Angell,  
County Analyst,  
Public Laboratory, Southampton.

Yours faithfully,  
SAMBROOKE NEWLYN,  
Secretary.

## B.

Norham Lodge,  
Shirley, Southampton,  
October 2nd, 1898.

My Dear Sir.—The state of the water in the river at this time is highly satisfactory. The figures are lower all round than at times of flood.

Yours faithfully,  
ARTHUR ANGELL.

Sambrooke Newlyn, Esq.

## C.

West Hampshire Water Company,  
Christchurch,  
October 4th, 1898.

Dear Sir.—I have just received Dr. Angell's analysis and report of the crude Avon water taken on the 26th October [*sic*.—? September] after prolonged drought. I enclose it to you and shall be glad if you will kindly return it as soon as convenient. I also enclose copy of a letter I sent to Dr. Angell with the sample of water.

I think, considering the lowness of the river and the many months of drought, the river water is not so bad as some people suppose.

I am, Dear Sir.  
Yours truly,  
SAMBROOKE NEWLYN,  
Secretary.

Dr. F. St. George Mivart,  
6, Edge Hill, Wimbledon.

## D.

Hants County Laboratory,  
Southampton,  
October 3rd, 1898.

To the West Hampshire Water Company.

*Analysis of, and Report on, a sample of water received on the 26th October*  
[*sic*.—? September], 1898.

*Description of Sample.*

Sample of crude water from the river Avon at the West Hampshire Water Company's intake at Knapp Mill, taken 11.30 a.m., September 26th, by S. Newlyn; state of river very low after a prolonged drought.

Physical Properties.

|                                         |     |     |     |     |                     |
|-----------------------------------------|-----|-----|-----|-----|---------------------|
| Colour at a depth of 2 feet             | ... | ... | ... | ... | Yellow.             |
| Smell when heated                       | ... | ... | ... | ... | River-like ; weedy. |
| Appearance of residue after evaporation | ... | ... | ... | ... | Discoloured.        |
| Turbidity                               | ... | ... | ... | ... | Bright and clear.   |
| Suspended matter                        | ... | ... | ... | ... | Very slight.        |

Chemical Analysis.

|                                             | Expressed in parts<br>per hundred<br>thousand. | Expressed in grs.<br>per Gallon. |
|---------------------------------------------|------------------------------------------------|----------------------------------|
| Free ammonia                                | ·0112                                          | ·00784                           |
| Albuminoid ammonia                          | ·0172                                          | ·01204                           |
| Oxygen absorbed in 15 minutes at 80 deg. F. | ·081                                           | ·0567                            |
| 4 hours                                     | ·1445                                          | ·1011                            |
| Nitrogen present as nitrates and nitrites   | ·1069                                          | ·0748                            |
| Chlorine                                    | 1·7                                            | 1·19                             |
| Calculated as common salt                   | 2·8                                            | 1·96                             |
| Phosphoric acid                             | Slight trace of                                | —                                |
| Poisonous metals                            | Not any.                                       | —                                |
| Total solids dried at 212 deg. F.           | 25·6                                           | 17·92                            |

Hardness by Clark's Scale.

|                         |     |     |                                  |
|-------------------------|-----|-----|----------------------------------|
| Total hardness, 13 deg. | ... | ... | { Fixed, 4·3 deg.                |
|                         |     |     | { Removable by boiling, 8·7 deg. |

Behaviour of Residue on Ignition.

Darkened considerably, odour of burning vegetable matter.

Microscopical and Biological Examination.

Usual river débris in very small quantity, river organisms.

Report.

This sample shews that the water in the river in times of drought does not deteriorate in quality.

ARTHUR ANGELL,  
Public Analyst.

Dated 3rd day of October, 1898.

E.

West Hampshire Water Company,  
Christchurch, 14th November, 1898.

Copy of Analysis and Report by Arthur Angell, Esq., County Analyst, on a sample of water obtained by him from the West Hampshire Water Company's Mains at a new building at Purewell, Christchurch, on the 7th November, 1898.

Physical Properties.

|                                         |     |     |     |                            |
|-----------------------------------------|-----|-----|-----|----------------------------|
| Colour at depth of 2 feet               | ... | ... | ... | A very faint yellow tinge. |
| Smell when heated                       | ... | ... | ... | Not noticeable.            |
| Appearance of residue after evaporation | ... | ... | ... | Clean.                     |
| Turbidity                               | ... | ... | ... | Bright.                    |
| Suspended matter                        | ... | ... | ... | None.                      |

Chemical Analysis.

|                                             | Grains per Gallon. |
|---------------------------------------------|--------------------|
| Free Ammonia—not any                        | —                  |
| Albuminoid ammonia                          | ·005               |
| Oxygen absorbed in 15 minutes at 80 deg. F. | ·052               |
| Do. do. 4 hours do.                         | ·071               |
| Nitrogen present as nitrates and nitrites   | ·069               |
| Chlorine                                    | 1·02               |
| Calculated as common salt                   | 1·68               |
| Phosphoric acid—slight trace of             | —                  |
| Poisonous metals—none                       | —                  |
| Total solids dried at 212 deg. F.           | 15·006             |

*Hardness by Clark's Scale.*

|                          |     |     |     |   |                                |
|--------------------------|-----|-----|-----|---|--------------------------------|
| Total hardness, 8·8 deg. | ... | ... | ... | { | Fixed, 4·2 deg.                |
|                          |     |     |     |   | Removable by boiling, 4·6 deg. |

*Behaviour of Residue on Ignition.*

Slightly darkened ; with slight odour of burning vegetable matter.

*Microscopical and Biological Examination.*

Satisfactory.

*Report.*

This sample shews that a slight peaty infusion interferes somewhat with the colour of the water, but the chemical figures remain nearly constant, whilst the entire absence of suspended matter proves that the water is well treated at the works.

Dated 14th November, 1898.

ARTHUR ANGELL,  
Public Analysis.

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